

CLAIMS

1. A rolling regeneration diesel particulate filtering process that reuses NO produced in the process to generate additional amounts of NO₂, comprising:

5 flowing diesel engine combustion exhaust through a filter system comprising a first section and a second section, and wherein the first section is positioned upstream of the second section with respect to the flow direction of the exhaust gas, and wherein the first section includes a foam constructed and arranged to trap carbon-based particulates in the exhaust, and a first catalyst carried by the foam to promote the conversion of NO in
10 the exhaust from the diesel engine to NO₂, and to promote the reaction of at least a portion of the particulates trapped in the foam with NO₂ to form CO and NO, and wherein the first catalyst carried by the foam further promotes the oxidation of CO to CO₂, and the oxidation of NO, generated by the reaction of NO₂ with carbon, to generate additional NO₂, and wherein the
15 second section includes a wall flow filter having at least one through hole cell formed therein running the longitudinal length of the wall flow filter, and the wall flow filter being constructed and arranged to trap particulates in the exhaust and to promote the reaction of NO₂ and C to produce NO and CO.

2. A process as set forth in claim 1 wherein the foam comprises a ceramic foam including Al₂O₃.

3. A process as set forth in claim 2 wherein the ceramic foam further includes ZrO₂.

4. A process as set forth in claim 1 wherein the foam comprises a ceramic foam including ZrO₂.

5. A process as set forth in claim 1 wherein the first catalyst comprises platinum.

6. A process as set forth in claim 1 wherein the first catalyst comprises platinum carried by the foam in a loading of at least 25 grams per cubic foot of foam.

7. A process as set forth in claim 1 wherein the foam has a porosity ranging from 80% to 90%.

8. A process as set forth in claim 1 wherein the foam includes 10 to 60 pores per inch.

9. A process as set forth in claim 1 wherein the wall flow filter includes 25 to 300 cells per square inch of cross-sectional area of the wall flow filter.

10. A process as set forth in claim 1 wherein the filter system further includes a housing, and wherein the first and second sections are carried in the housing.

11. A rolling regeneration diesel particulate filter system comprising:

5 a first section and a second section, and wherein the first section is positioned upstream of the second section, and wherein the first section includes a foam constructed and arranged to trap carbon-based particulates in diesel engine exhaust flowing through the filter, and a first catalyst carried by the foam to promote the conversion of NO in the diesel engine exhaust to NO₂, and the first catalyst being designed to promote the reaction of NO₂ with at least a portion of the carbon-based particulates trapped by the foam to

- 10 form CO and NO, and wherein the first catalyst carried by the foam further promotes the oxidation of CO to CO₂, and the oxidation of NO, generated by the reaction of NO₂ with carbon, to generate additional NO₂, and wherein the second section includes a wall flow filter having at least one through hole cell formed therein running the longitudinal length of the wall flow filter,
- 15 and the wall flow filter being constructed and arranged to trap particulates in the diesel engine exhaust flowing through the wall flow filter and to promote the reaction of NO₂ and C to produce NO and CO.

12. A system as set forth in claim 11 wherein the foam comprises a ceramic foam including Al₂O₃.

13. A system as set forth in claim 12 wherein the ceramic foam further includes ZrO₂.

14. A system as set forth in claim 11 wherein the foam comprises a ceramic foam including ZrO₂.

15. A system as set forth in claim 11 wherein the first catalyst comprises platinum.

16. A system as set forth in claim 11 wherein the first catalyst comprises platinum carried by the foam in a loading of at least 25 grams per cubic foot of foam.

17. A system as set forth in claim 11 wherein the foam has a porosity ranging from 80% to 90%.

18. A system as set forth in claim 11 wherein the foam includes 10 to 60 pores per inch.

19. A system as set forth in claim 11 wherein the wall flow filter includes 25 to 300 cells per square inch of cross-sectional area of the wall flow filter.

20. A system as set forth in claim 11 further comprising a housing, and wherein the first and second sections are carried in the housing.

21. A rolling regeneration diesel particulate filtering process that reuses NO produced in the process to generate additional amounts of NO₂, comprising:

flowing diesel engine combustion exhaust through a first section
5 of a filter system and thereafter flowing the exhaust through a second section of the filter system, and wherein the first section includes a foam constructed and arranged to trap carbon-based particulates in the exhaust, and a first catalyst carried by the foam to promote the conversion of NO in the exhaust from the diesel engine to NO₂, and to promote the reaction of at least a
10 portion of the particulates trapped in the foam with NO₂ to form CO and NO, and wherein the first catalyst carried by the foam further promotes the oxidation of CO to CO₂, and the oxidation of NO, generated by the reaction of NO₂ with carbon, to generate additional NO₂, and wherein the second section includes a wall flow filter having at least one through hole cell
15 formed therein running the longitudinal length of the wall flow filter, and the wall flow filter being constructed and arranged to trap particulates in the exhaust and to promote the reaction of NO₂ and C to produce NO and CO.

22. A diesel engine exhaust filter system comprising:

a catalyzed foam filter and wall flow filter combination, wherein at least a portion of the wall flow filter surrounds a portion of the catalyzed foam filter and so that exhaust may flow through the catalyzed foam filter
5 and then flow through the wall flow filter.

23. A system as set forth in claim 22 further comprising a conduit having a cavity defined by an inner surface and wherein the combination is received in the cavity.

24. A system as set forth in claim 23 wherein the catalyzed foam filter includes a front face, and further comprising a separator connected to the inner surface and the separator having an opening therethrough, and wherein the combination is supported by the separator so that the opening
5 exposes the front face of the catalyzed foam filter.

25. A system as set forth in claim 22 wherein the catalyzed foam filter includes a side edge and a rear face and wherein the wall flow filter surrounds at least a portion of the side edge.

26. A system as set forth in claim 25 wherein the wall flow filter surrounds the rear face of the catalyzed foam filter.

27. A system as set forth in claim 22 wherein the wall flow filter is a single cell wall flow filter.

28. A system as set forth in claim 25 wherein the wall flow filter comprises a porous wall spaced a distance from the side edge.

29. A system as set forth in claim 28 wherein the porous wall is spaced a distance from the rear face of the catalyzed foam filter.

30. A diesel engine exhaust filter system comprising:
a plurality of filter combinations, and wherein each filter combination includes a catalyzed foam filter and wall flow filter, and wherein at least a portion of each wall flow filter surrounds a portion of a

- 5 catalyzed foam filter and so the exhaust may flow through the catalyzed foam filter and then flow through the wall flow filter.

31. A system as set forth in claim 30 further comprising a conduit having a cavity defined by an inner surface and wherein each combination is received in the cavity.

32. A system as set forth in claim 31 wherein each catalyzed foam filter includes a front face, and further comprising a separator connected to the inner surface and the separator having a plurality of openings therethrough, and wherein each opening is constructed and
5 arranged to expose the front face of one of the catalyzed foam filters.

33. A system as set forth in claim 30 wherein each catalyzed foam filter includes a side edge and wherein one of the wall flow filters surrounds at least a portion of the side edge.

34. A system as set forth in claim 33 wherein each catalyzed foam filter further includes a rear face and wherein the wall flow filter surrounds the rear face of the catalyzed foam filter.